The Economics of Reduced Impact Logging in the American Tropics: A Review of Recent Initiatives

by

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Abstract

Programs aimed at developing and implementing reduced-impact logging (RIL) techniques are currently underway in important forest regions of Latin America, given the importance of timber production in the American tropics to national and global markets. RIL efforts focus upon planning and extraction methods which lessen harvest impact on residual commercial timber stocks, forest soils and vegetation, and ecological functions. Although the ecological benefits of RIL practices are widely acknowledged, forest management actions are commonly guided by policy constraints and economic decision-making which preclude the adoption of more conservative RIL practices. A review of forest management projects in Central and South America illustrates the ecological and economic benefits of RIL as well as constraints to greater adoption of RIL in forest management activities in the American tropics.

INTRODUCTION

The conversion of tropical forests to alternative land uses and the degradation of productive forests by poor logging practices are problems of critical global concern. Despite increased recognition of the dire consequences of unsustainable forest management, the rate of forest destruction in the tropics has increased over the past decade, in tune with rising demographic pressures and decreasing availability of productive resources in settled areas. From 1980 to 1985, annual deforestation rates in the tropics were estimated at 11.4 million hectares (Rowe et al. 1992), while more recent studies estimate an increase to some 15.4 million hectares (Heinrich 1997). In a period of just three decades, 1960 to 1990, one fifth of all natural tropical forest cover was lost in developing countries (Singh and Marzoli 1995).

Logging activities in Latin America have increased in intensity and scale over the past two decades, expanding also the extent of forest conversion and degradation. Logging is considered by many to be the main threat to frontier forests of the American tropics, endangering about 70 percent of all South American frontiers classified under medium or high threat by the World Resources Institute (Bryant et al. 1997). Throughout Latin America, timber harvest in natural forests is often the initial step in a process of conversion of forestland to alternative land uses offering greater immediate financial returns (e.g., Fearnside 1989, Quirós et al. 1997). The extensive canopy openings and the piles of slash left after logging open forested areas to the encroachment of fires (Uhl and Buschbacher 1985) and facilitate the conversion of forests to agricultural and pastoral uses.

Global recognition of the economic and ecological importance of tropical forests has triggered policy reform and efforts in the practical application of sustainable forest management (SFM) practices. Forestry received focused attention at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 under *Agenda 21*. Annex III "Forest Principles" emphasizes that "forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations" (UNCED 1992).

An integral component of SFM systems, reduced-impact logging (RIL) practices are being developed and implemented in selected ecosytems of the American tropics given the importance of this region to tropical timber markets. RIL research and demonstration projects are currently underway in Brazil, Bolivia, Costa Rica, Guyana, Guatemala and Peru. The present review describes the problems posed by conventional logging practices and enumerates the benefits of RIL systems. Results of recent studies comparing RIL and conventional logging are examined and constraints to the adoption of RIL in forest management activities are discussed.

Trends in Tropical Timber Production–Harvest of industrial roundwood is arguably the most important commercial use of tropical forests, in response to a sustained global demand for tropical timber products.

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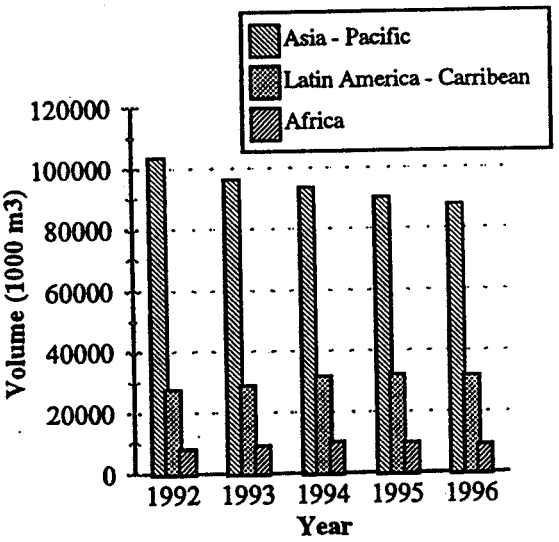
Forest management provides important revenues for national economies of the tropics, offering means of generating local and export revenues, servicing national debt and catalyzing the development of rural areas (e.g., Johnson and Cabarle 1993).

Logging firms commonly bear the charge of developing roads and provide new sources of employment and income in previously inaccessible forested regions. In most cases however, progress in economic development is short-lived, as timber harvest practices in tropical developing countries are rarely sustainable. In 1980, the FAO's Forest Resource Assessment found that less than 5% of tropical forests were being managed for sustained yield harvest with strictly controlled harvest and post-harvest operations, while the 1990 assessment found that the total area under sustainable management had effectively declined (FAO 1997).

Schmidt (1987), noting the trend of unsustainable forest land use in his review of tropical rainforest management, argued that the disappearance of commercially productive forests is imminent in some countries, while in others where the process is developing more slowly it is principally due to the inaccessibility of remaining forest lands. Those areas once under little pressure for timber production are now increasingly the focus of logging industry development on national and international scales. This is of particular significance for forested nations of the American tropics. As timber supply from natural forests of tropical Asia becomes more restricted, due to decreases in hardwood stocks, global markets for tropical timber are increasingly turning to resources contained in the forests of Latin America, and particularly to the rich stocks of Amazonia (e.g., Uhl et al. 1997).

According to ITTO assessments, growth in the Latin American and African share of total tropical timber production will likely continue to the turn of the century and beyond, as few of ITTO's Asian members have the potential to substantially increase log production sustainably (ITTO 1996a). Trends in roundwood production presented in Figure 1 show a decrease in the Asia-Pacific region's share of global log production by 5.8% from 1992 to 1996. Production in the Latin America-Carribean region increased 4.7% over this period.

Figure 1: Industrial Roundwood Production by Region: ITTO Producers (ITTO 1996a)



CONVENTIONAL LOGGING

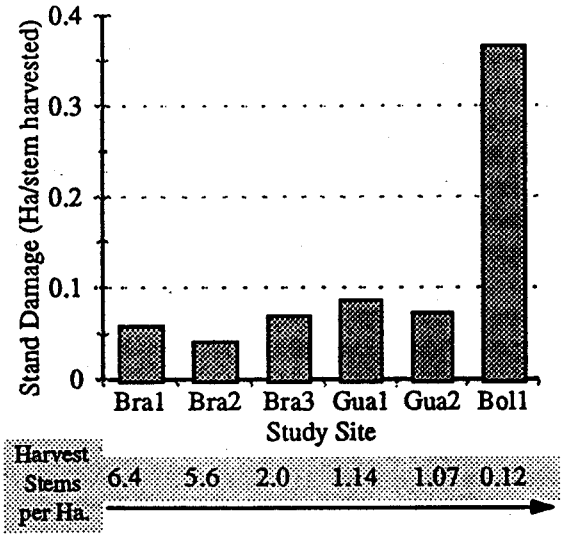
Damages caused during conventional logging operations frequently result in a marked decline in forest productivity according to economic and ecological measures. Forest ecosystems are impaired as residual growing stock suffers significant mortality, compacted soils inhibit seedling growth, vines and weeds grow prolifically and suppress tree growth, soils suffer excessive nutrient loss, and road areas and logged slopes generate considerable erosion and hydrological disturbance (Uhl and Vieira 1989, Pinard and Putz 1996).

Studies conducted in the Brazilian Amazon by a private voluntary research organization, *Instituto do Homem e do Meio Ambiente da Amazônia* (IMAZON), offer compelling testimony of the destructive consequences of conventional logging. IMAZON's results indicate that on intensively logged sites nearly 30 trees over 10 cm diameter at breast height (dbh) are destroyed for each stem harvested and canopy cover is often reduced to under 50% (Veríssimo et al. 1992, Johns et al. 1996, Uhl et al. 1997).

Figure 2 presents the results of six case studies of conventional logging ranging from high intensity industrial logging in Paragominas, Brazil to low-intensity, selective logging in Chimanes, Bolivia. Stand disturbance in terms of ground area (Ha.) cleared for roads, skid trails, landings and felling gaps is important in all cases. The magnitude of stand damage is not proportional to the number of stems felled, supporting findings of the CELOS trials in Suriname (Jonkers 1988) that higher yield harvests cause less damage per stem extracted. This is of considerable importance given that conventional logging systems commonly focus

upon high-grade liquidation harvest upon initial entry into unexploited forest areas.

Figure 2: Ground Area Disturbance Caused by Conventional Logging Practices[2]



Since UNCED, efforts to improve forest management practices in tropical developing countries have been expanded and intensified. Particular focus has been drawn to commercially productive forest regions of Southeast Asia and Latin America. Most of these initiatives follow standards of forest management designed to meet multiple objectives of sustained commercial production, long-term, equitable social benefits and conservation of biological wealth and ecological functions.

REDUCED-IMPACT LOGGING

Principal among current efforts to reform forest management policies and practices in the tropics are projects aimed at introducing harvest techniques that lessen the deleterious ecological and economic impacts of forest operations. RIL projects focus on lowering damage to commercial inventory and minimizing impacts on forest ecosystem function through improved techniques of planning and extraction (Pinard et al. 1995, TFF 1996, Uhl et al. 1997).

RIL is an essential component of sustainable forest management systems, which aim to preserve productivity and natural function in order to maintain benefit flows from forest ecosystems. RIL operations generally include the following fundamental technical elements (ITTO 1996b):

- pre-harvest inventory and mapping,
- pre-harvest planning of roads and skid trails,
- pre-harvest vine cutting,
- directional felling,
- low stumps,
- efficient utilization of felled trunks,
- optimum width of roads and skid trails,
- winching of logs to planned skid trails,
- minimal ground disturbance,
- slash management.

RIL initiatives are founded upon the precept that the economic importance of tropical timber ensures that logging activities will continue in those areas not set-aside for strict environmental protection, such as parks and nature reserves. Furthermore, it is acknowledged that the harvest of tropical timber will expand to frontier forests as hardwood stocks of current productive areas are depleted (e.g., Bryant et al. 1997).

RIL methods have been developed to promote the conservation of productive forests and the vital ecological services they provide. Benefits of RIL management may include:

- conservation of a forest's productive capacity for merchantable timber and non-timber products,
- improved carbon retention,
- soil and nutrient conservation,
- maintenance of hydrological functions,
- maintenance of forest structure,
- biodiversity conservation (e.g., Pinard and Putz 1996).

Economics of Reduced-Impact Logging--While the benefits of RIL are widely acknowledged, the incremental costs of adopting more sustainable forest management practices are commonly viewed as a principal impediment to their adoption by loggers. Simulation studies in the Chimanes forest of Bolivia (Howard et al. 1996) indicate a net loss of short-term profits of 35% to 67% due to the adoption of more sustainable harvesting regimes. The incremental costs of RIL operations lie primarily in the extensive planning and pre-harvest stand management activities. Case studies in Latin America have shown a potential cost increase of $27 to $72 per hectare (Quirós et al. 1997, Johns et al. 1996).

When harvest efficiency -- including resource use efficiency and temporal efficiency of the logging operation -- is considered in the economic analysis,

[2] Projects represented in Figure 2 include: Bra1: Brazil (Veríssimo et al. 1992); Bra2: Brazil (Johns et al. 1996); Bra3: Brazil (Uhl et al. 1991); Gua1, Gua2: Guatemala (Gretzinger 1996); Bol1: Bolivia (Gullison and Hardner 1993).

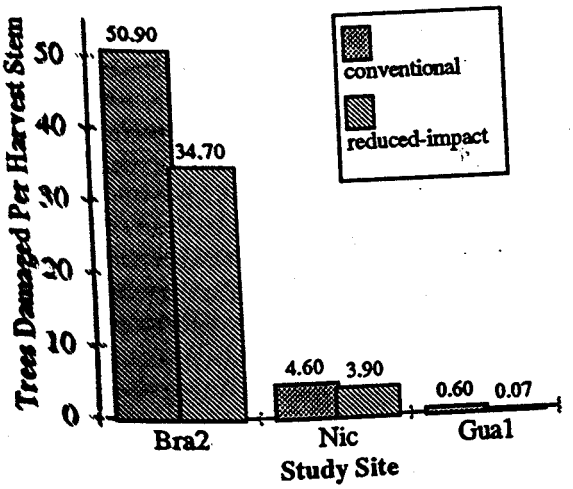
increased initial costs of RIL may be recovered in decreased machine and labor costs and decreased logging waste (Uhl et al. 1997). Johns et al. (1996) provide evidence of a 1% decrease in harvest cost per cubic meter (m^3) and a net increase in profits of 1% for RIL in Paragominas, Brazil when harvest efficiency is considered. CELOS trials in Suriname (Boxman et al. 1985) also noted a 10 to 20% decrease in costs due to gains in efficiency.

IMAZON's research in the Brazilian Amazon (Uhl et al. 1997) indicates that the efficiency benefits of RIL forest management systems have clear relevance to economic returns. In side-by-side plot studies of RIL and conventional operations, IMAZON found :

- less waste of cut timber during logging ($7m^3$/Ha.);
- a 25% reduction in ground area disturbed ;
- 30% less damage to residual trees during felling;
- a threefold reduction in felling and bucking waste;
- 20% less machine operating time.

Studies across Latin America show considerable gains in management efficiency and conservation of residual timber resources with RIL. Figure 3 shows the results of comparative studies of RIL and conventional practices in terms of damage to residual stems.

Figure 3: Harvest Level and Damages to Residual Stems in RIL vs. CL Operations[3]



[3] Projects represented in Fig. 3 include: Bra2: Brazil (Johns et al. 1996); Nic: Nicaragua: (Castañeda et al. 1994); Gua1: Guatemala (Gretzinger 1996)

Constraints to the Adoption of RIL--Constraints to the adoption of more sustainable forest management practices such as RIL persist on national and local scales in Latin America. Macroeconomic forces in the developing economies of Latin America create unfavorable conditions for more sustainable forest management which involves greater pre-harvest investment and conservation of valuable timber resources for future harvest. High real interest rates of 10 to 20% common in Latin American economies and the resultant elevated opportunity costs of capital renders investment in long term management of slow growing tropical hardwoods economically unattractive (e.g., Kishor and Constantino 1993, Rice et al. 1997).

Policy distortions favoring the conversion of "unproductive" forest lands persist in many countries of Latin America whose rural economies are dominated by agriculture and ranching and whose forests are often viewed as an impediment to development (e.g., Quirós et al. 1997). In Latin America, about 60 percent of forest change during the 1980s occurred because of the direct conversion of forest to other land types, primarily as a result of large-scale projects to settle and develop forested regions (WRI et al. 1996).

A fundamental precept of the *FAO Model Code of Forest Harvesting Practice* is that conducting harvesting operations consistent with sustainable forest management generally requires the development of a competent and properly motivated workforce (Dykstra 1997). It is likely that the up-front costs of building technical capacities for planning and more efficient extraction are a principal impediment to greater adoption of RIL practices, given the relatively low incremental costs of RIL harvest operations suggested in most Latin American cases. Studies in Malaysia corroborate claims that the need for investment in equipment and training to implement RIL may be an important disincentive to adoption (Moura-Costa and Tay 1996). Training and technology costs are not considered in many of the case studies reviewed, though certainly fundamental to logging firms' economic appraisal of RIL as a management option.

Perhaps the most important constraint to greater adoption of more sustainable forest management practices is the lack of private demand for this type of land use (Kishor and Constantino 1994). SFM is rarely practiced in Latin America, as elsewhere in the humid tropics, because there is often no economic incentive to invest in such practices (e.g., Howard and Valerio 1996, Rice et al. 1997). Fear that the up-front costs of adopting RIL will diminish the excessive profits commonly garnered in conventional harvest activities, and inadequate information on the economic benefits of

more sustainable forest management pose an important obstacle to greater adoption.

CONCLUSIONS

It is deceptively simple to show that the adoption of more stringent and costly management standards is uneconomic from the perspective of the logger, whose sole interest is often the financial profitability of the initial timber harvest (Leslie 1987). Economic criteria for evaluation of forest management and land-use options commonly include only the most immediate costs and benefits of investment and intervention, while management efficiency and subsequent harvest yields are rarely considered in economic assessments. Moreover, non-revenue producing benefits and external effects, which are of significance on national and global scales, are not financially relevant criteria for most conventional logging endeavors.

The full value of benefits derived from RIL practices will not be evident in returns to the initial harvest, even if more appropriate criterion is applied. It is expected that many of the economic benefits from RIL practices will be of a long term nature. Such benefits will be expressed in the conservation of future harvest species, the regeneration of commercial growing stock, and the preservation of non-market benefits derived from the sound functioning of natural forest ecosystems.

The success of policy and market initiatives to promote sustainable forest management in tropical closed forests will depend upon tangible measures ensuring that it is both technically feasible and economically attractive for conventional loggers and forest landowners. Enabling policies and economic incentives for the adoption of RIL methods will be critical to the success of current initiatives to promote more sustainable forest management in Latin America.

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